

Hadronic energy estimate

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Short report
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Outline

- Introduction
- Energy estimate method
- Calibration
- SF decoder normalization
- Conclusions
- Outlook



Introduction

- We currently have energy/momentum estimates for electrons and muons
 - Rosie and EMCAL
- We would like to know shower energies for electromagnetic and hadronic showers
 - from the SF system
- The energy can be estimated from hit-counting in the SF system
 - how do we normalize/calibrate it?



Method

- Long report, 23Apr99:
 - estimate electromagnetic energy
 - error: $\frac{\Delta E}{E} = \frac{0.45}{\sqrt{E}}$
- The same algorithm can be used to find the energy of a hadron shower
 - add up the number of the SF hits for each module (1cm cut only for EM energy)
 - add up the number of VC hits
 - combine them to an energy estimator depending on the run period and vertex module

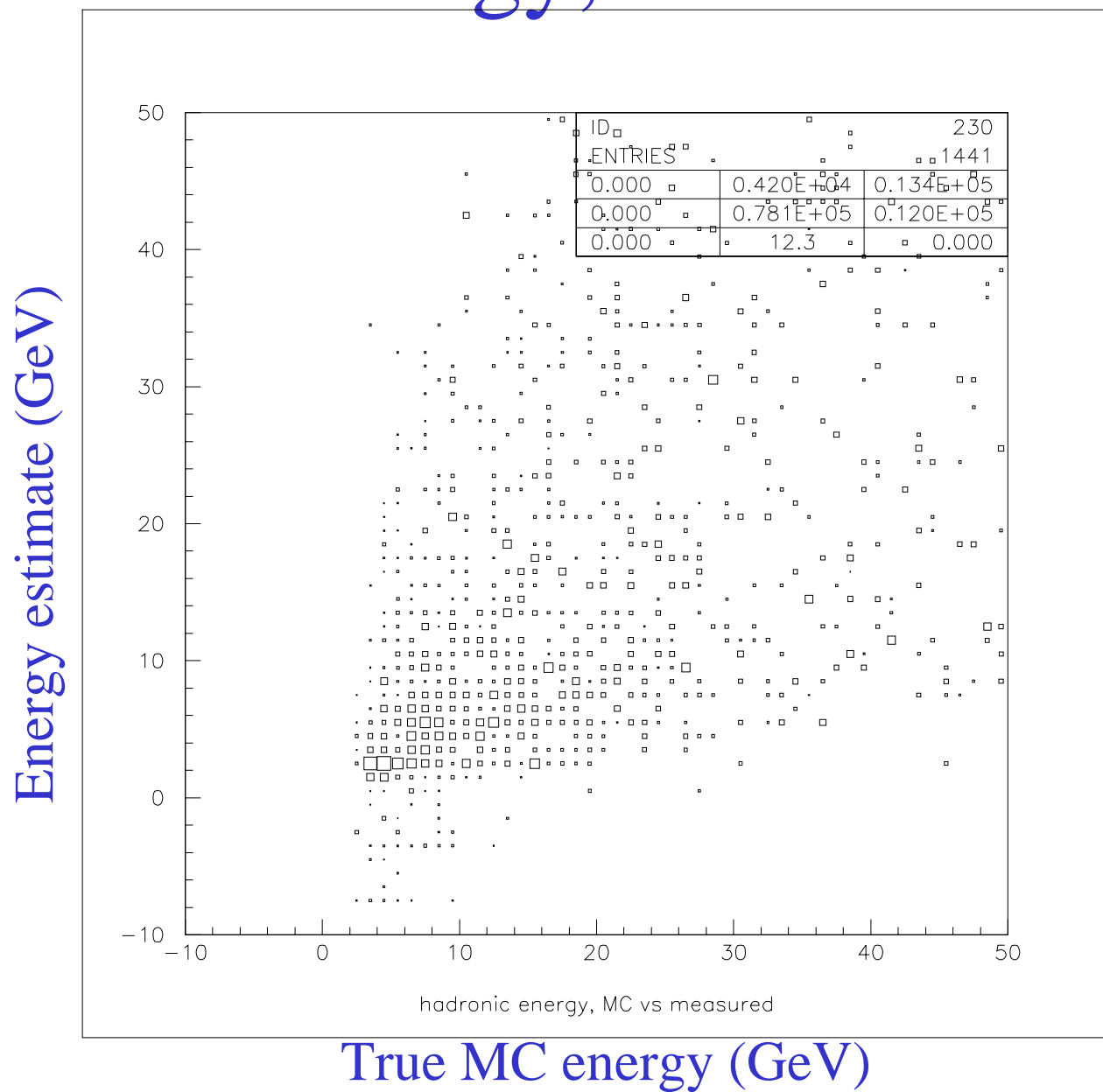


Calibration

- Calibrate the electromagnetic energy with 2GeV and 10GeV single electrons
 - new SF decoder
 - the new SF decoder MC produces approximately the correct number of hits
- Calibrate the hadronic energy with ν_μ CC events
 - new SF decoder
 - MC: neutrino energy - μ energy
 - check: histogram for data events should look similar

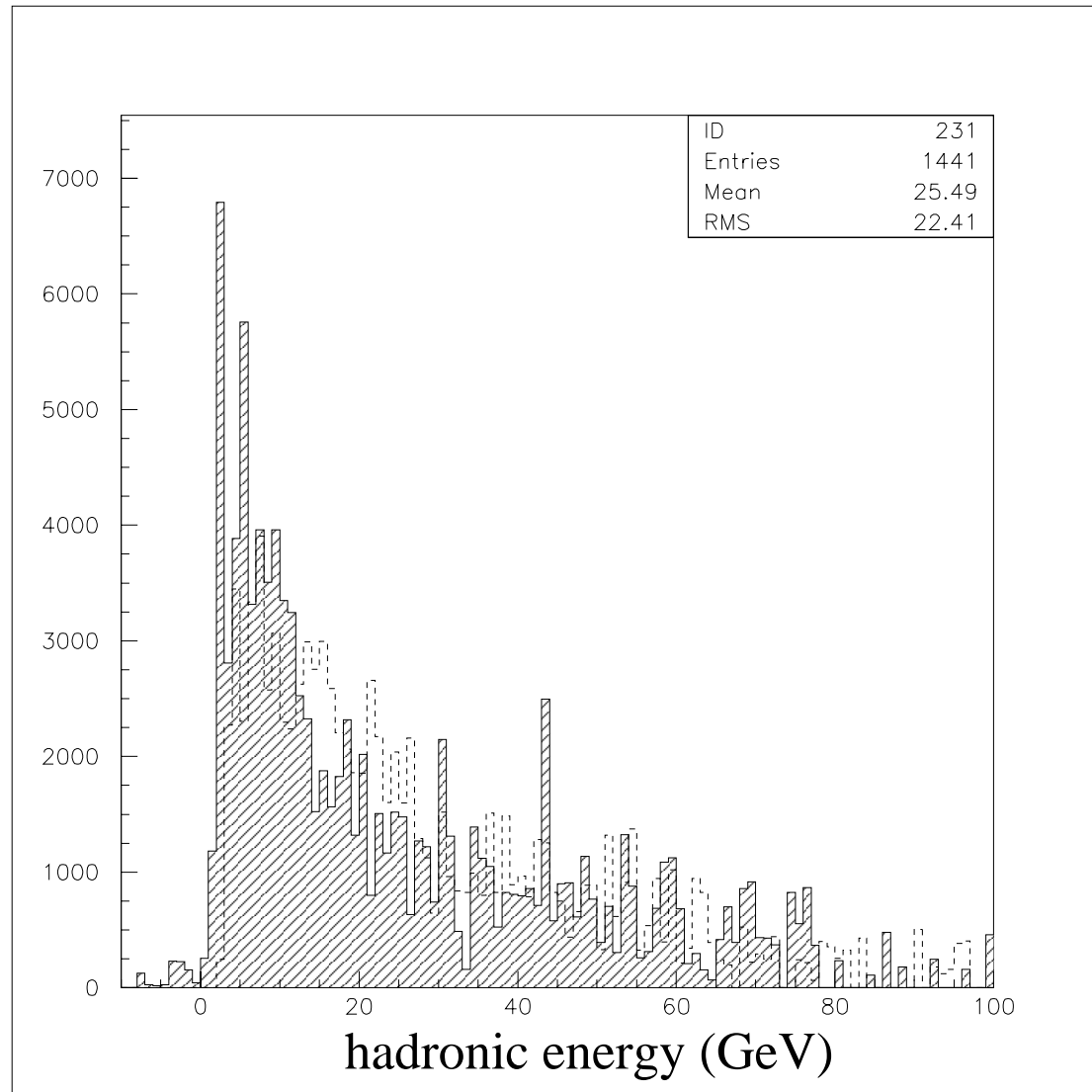


Hadronic energy, true vs estimate

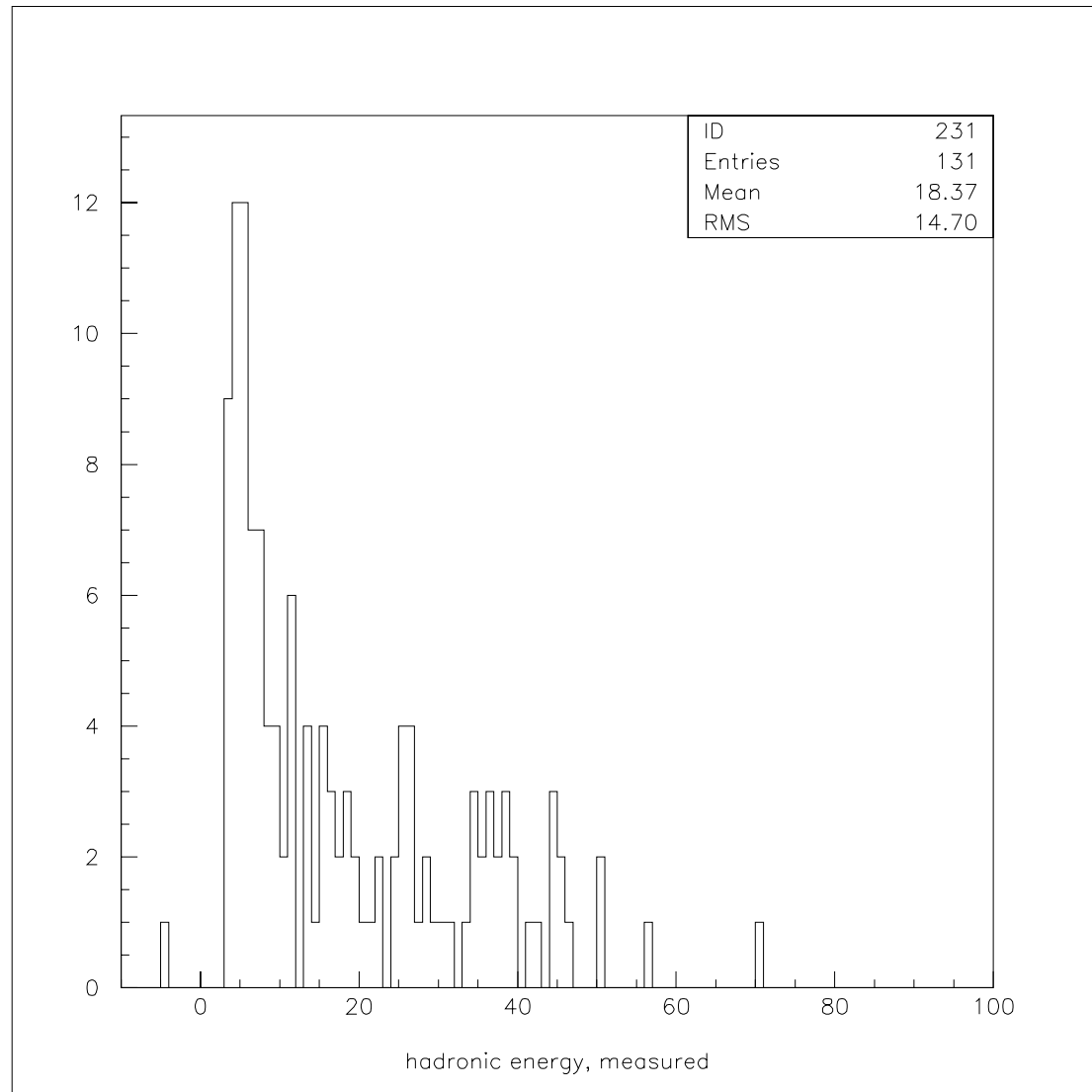


Hadronic energy, period 4

solid histogram:
energy estimate
dashed histogram:
true energy



Hadronic energy, data

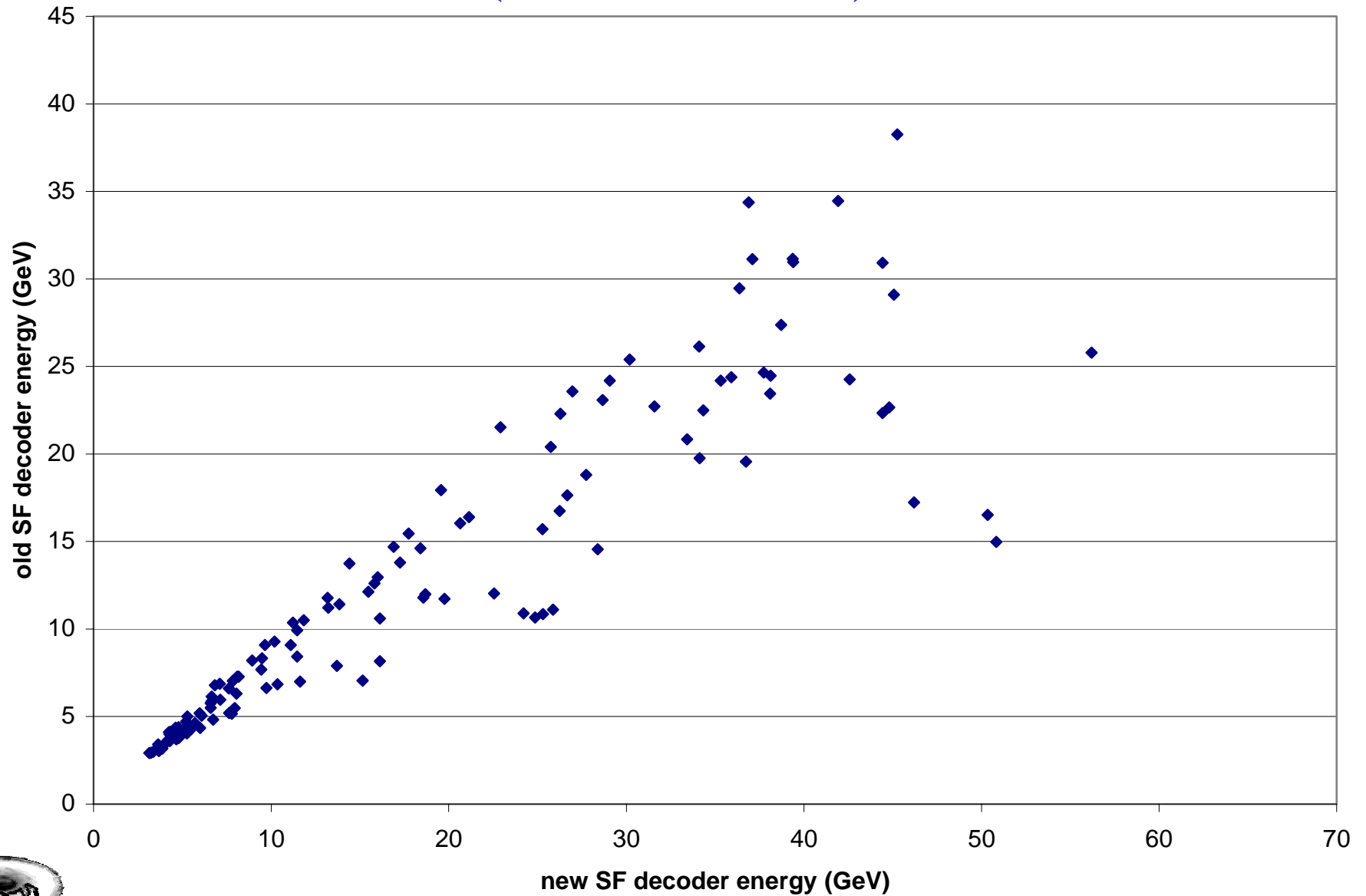


SF decoder normalization

- We usually only use the old SF decoder
 - clean tracking
- The new SF decoder was used to calibrate the energy estimate
- A normalization factor
new SF decoder \rightarrow *old SF decoder*
is necessary
 - use data events



SF decoder comparison (uncorrected)



Hadronic energy summary

- The uncertainty is $\frac{\Delta E}{E} = 0.26 + \frac{1.4}{\sqrt{E}}$
 - for all vertex modules and run periods
- At large energies ($>25\text{GeV}$) the estimate is typically too low



Conclusions

- The SF system can be used to estimate electromagnetic and hadronic energy of an event
- The resolutions are:
 - $45\% / \sqrt{E}$ for electromagnetic energy
 - $26\% + 140\% / \sqrt{E}$ for hadronic energy
- The absolute normalization will not be perfect until we know our spectrum
 - the histogram means will not agree until then
- The subroutine (sfenergy.sf) has been sent to Bruce



Outlook

- The energy measurements (hadronic, electromagnetic, EMCAL) have to be combined to find the neutrino energy
 - so far, this is straight forward only for ν_μ CC events
- As our understanding of the spectrum gets better, the normalization has to be updated

